



General

Guideline Title

Congress of Neurological Surgeons systematic review and evidence-based guidelines on hearing preservation outcomes in patients with sporadic vestibular schwannomas.

Bibliographic Source(s)

Carlson ML, Vivas EX, McCracken DJ, Sweeney AD, Neff BA, Shepard NT, Olson JJ. Congress of Neurological Surgeons systematic review and evidence-based guidelines on hearing preservation outcomes in patients with sporadic vestibular schwannomas. *Neurosurgery*. 2018 Feb 1;82(2):E35-9. [99 references] [PubMed](#)

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

NEATS Assessment

National Guideline Clearinghouse (NGC) has assessed this guideline's adherence to standards of trustworthiness, derived from the Institute of Medicine's report [Clinical Practice Guidelines We Can Trust](#).

■■■■= Poor ■■■■= Fair ■■■■= Good ■■■■= Very Good ■■■■= Excellent

Assessment	Standard of Trustworthiness
YES	Disclosure of Guideline Funding Source
■■■■	Disclosure and Management of Financial Conflict of Interests
	Guideline Development Group Composition
YES	Multidisciplinary Group

UNKNOWN	Methodologist Involvement
■□□□□	Patient and Public Perspectives
	Use of a Systematic Review of Evidence
■■■■■	Search Strategy
■■■■■	Study Selection
■■■■■	Synthesis of Evidence
	Evidence Foundations for and Rating Strength of Recommendations
■■■□□	Grading the Quality or Strength of Evidence
■■■□□	Benefits and Harms of Recommendations
■■■■■	Evidence Summary Supporting Recommendations
■■■□□	Rating the Strength of Recommendations
■■■■■	Specific and Unambiguous Articulation of Recommendations
■□□□□	External Review
■■■□□	Updating

Recommendations

Major Recommendations

Definitions for the classification of evidence (I-III) and levels of recommendations (1-3) are provided at the end of the "Major Recommendations" field.

Please see the full-text version of this guideline (see the "Availability of Companion Documents" field) for the target population of each recommendation listed below.

Stereotactic Radiosurgery

Question 1

What is the overall probability of maintaining serviceable hearing following stereotactic radiosurgery utilizing modern dose planning, at 2, 5, and 10 yr following treatment?

Recommendation

Level 3: Individuals who meet these criteria and are considering stereotactic radiosurgery should be counseled that there is moderately high probability (>50%- 75%) of hearing preservation at 2 yr, moderately high probability (>50%-75%) of hearing preservation at 5 yr, and moderately low probability (>25%-50%) of hearing preservation at 10 yr.

Question 2

Among patients with AAO-HNS (American Academy of Otolaryngology–Head and Neck Surgery hearing classification) class A or GR (Gardner-Robertson hearing classification) grade I hearing at baseline, what is the overall probability of maintaining serviceable hearing following stereotactic radiosurgery, utilizing modern dose planning, at 2, 5, and 10 yr following treatment?

Recommendation

Level 3: Individuals who meet these criteria and are considering stereotactic radiosurgery should be counseled that there is a high probability (>75%-100%) of hearing preservation at 2 yr, moderately high probability (>50%-75%) of hearing preservation at 5 yr, and moderately low probability (>25%-50%) of hearing preservation at 10 yr.

Question 3

What patient- and tumor-related factors influence progression to nonserviceable hearing following stereotactic radiosurgery using ≤ 13 Gy to the tumor margin?

Recommendation

Level 3: Individuals who meet these criteria and are considering stereotactic radiosurgery should be counseled regarding the probability of successful hearing preservation based on the following prognostic data: the most consistent prognostic features associated with maintenance of serviceable hearing are good preoperative word recognition and/or pure tone thresholds with variable cut-points reported, smaller tumor size, marginal tumor dose ≤ 12 Gy, and cochlear dose ≤ 4 Gy. Age and sex are not strong predictors of hearing preservation outcome.

Microsurgery

Question 4

What is the overall probability of maintaining serviceable hearing following microsurgical resection of small to medium-sized sporadic vestibular schwannomas early after surgery, at 2, 5, and 10 yr following treatment?

Recommendation

Level 3: Individuals who meet these criteria and are considering microsurgical resection should be counseled that there is a moderately low probability (>25%- 50%) of hearing preservation immediately following surgery, moderately low probability (>25%-50%) of hearing preservation at 2 yr, moderately low probability (>25%-50%) of hearing preservation at 5 yr, and moderately low probability (>25%-50%) of hearing preservation at 10 yr.

Question 5

Among patients with AAO-HNS class A or GR grade I hearing at baseline, what is the overall probability of maintaining serviceable hearing following microsurgical resection of small to medium-sized sporadic vestibular schwannomas early after surgery, at 2, 5, and 10 yr following treatment?

Recommendation

Level 3: Individuals who meet these criteria and are considering microsurgical resection should be counseled that there is a moderately high probability (>50%- 75%) of hearing preservation immediately following surgery, moderately high probability (>50%-75%) of hearing preservation at 2 yr, moderately high probability (>50%-75%) of hearing preservation at 5 yr, and moderately low probability (>25%-50%) of hearing preservation at 10 yr.

Question 6

What patient- and tumor-related factors influence progression to nonserviceable hearing following microsurgical resection of small to medium-sized sporadic vestibular schwannomas?

Recommendation

Level 3: Individuals who meet these criteria and are considering microsurgical resection should be counseled regarding the probability of successful hearing preservation based on the following prognostic data: the most consistent prognostic features associated with maintenance of serviceable hearing are good preoperative word recognition and/or pure tone thresholds with variable cut-points reported, smaller tumor size commonly less than 1 cm, and presence of a distal internal auditory canal cerebrospinal fluid fundal cap. Age and sex are not strong predictors of hearing preservation outcome.

Conservative Observation

Question 7

What is the overall probability of maintaining serviceable hearing with conservative observation of vestibular schwannomas at 2, 5, and 10 yr following diagnosis?

Recommendation

Level 3: Individuals who meet these criteria and are considering observation should be counseled that there is a high probability (>75%-100%) of hearing preservation at 2 yr, moderately high probability (>50%-75%) of hearing preservation at 5 yr, and moderately low probability (>25%-50%) of hearing preservation at 10 yr.

Question 8

Among patients with AAO-HNS class A or GR grade I hearing at baseline, what is the overall probability of maintaining serviceable hearing with conservative observation at 2 and 5 yr following diagnosis?

Recommendation

Level 3: Individuals who meet these criteria and are considering stereotactic radiosurgery should be counseled that there is a high probability (>75%-100%) of hearing preservation at 2 yr, and moderately high probability (>50%-75%) of hearing preservation at 5 yr. Insufficient data were available to determine the probability of hearing preservation at 10 yr for this population subset.

Question 9

What patient and tumor-related factors influence progression to nonserviceable hearing during conservative observation?

Recommendation

Level 3: Individuals who meet these criteria and are considering observation should be counseled regarding probability of successful hearing preservation based on the following prognostic data: the most consistent prognostic features associated with maintenance of serviceable hearing are good preoperative word recognition and/or pure tone thresholds with variable cut-points reported, as well as nongrowth of the tumor. Tumor size at the time of diagnosis, age, and sex do not predict future development of nonserviceable hearing during observation.

Definitions

American Association of Neurological Surgeons/Congress of Neurological Surgeons Classification of Evidence on Prognosis and Levels of Recommendation

To evaluate papers addressing *prognosis*, 5 technical criteria are applied:

Was a well-defined representative sample of patients assembled at a common (usually early) point in the course of their disease?

Was patient follow-up sufficiently long and complete?

Were objective outcome criteria applied in a "blinded" fashion?

If subgroups with different prognoses were identified, was there adjustment for important prognostic

factors?

If specific prognostic factors were identified, was there validation in an independent "test set" group of patients?

Class I Evidence Level 1 Recommendation	All 5 technical criteria above are satisfied
Class II Evidence Level 2 Recommendation	Four of 5 technical criteria are satisfied
Class III Evidence Level 3 Recommendation	Everything else

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Vestibular schwannomas

Guideline Category

Counseling

Clinical Specialty

Neurological Surgery

Neurology

Otolaryngology

Intended Users

Physicians

Guideline Objective(s)

To summarize the probability of hearing preservation within the first 10 years after contemporary stereotactic radiation delivery, microsurgery, or observation with serial imaging

Target Population

Adults with sporadic vestibular schwannomas

Interventions and Practices Considered

Counseling regarding the probability of successful hearing preservation

Major Outcomes Considered

Patient knowledge about hearing preservation rates

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Process Overview

The evidence-based clinical practice guideline task force members and the Joint Tumor Section of the American Association of Neurological Surgeons (AANS) and the Congress of Neurological Surgeons (CNS) conducted a systematic review of the literature relevant to the management of vestibular schwannomas (VSs). Additional details of the systematic review are provided below and within the introduction and methodology chapter of the guideline (see the "Availability of Companion Documents" field).

Article Inclusion/Exclusion Criteria

One thousand three hundred and seven citations were manually reviewed by the team with specific inclusion and exclusion criteria as outlined below. Three independent reviewers reviewed and abstracted full-text data for each article, and the 2 sets of data were compared for agreement by a third party. Inconsistencies were re-reviewed, and disagreements were resolved by consensus. To be included in this guideline, an article has to be a study that:

General

- Investigated patients suspected of having VSs
- Was of humans
- Was not an in vitro study
- Was not a biomechanical study
- Was not performed on cadavers
- Was published between January 1, 1990 and December 31, 2014
- Was published in a peer-reviewed journal
- Was not a meeting abstract, editorial, letter, or a commentary
- Was published in English
- Included quantitatively presented results

Specific

- Used the 1995 American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) or Gardner-Robertson (GR) hearing classification system or presented data using a cut-off of $\geq 50\%$ word recognition score and ≤ 50 dB pure tone average for defining serviceable hearing or had individual patient data presented such that the latter criteria could be applied and analyzed
- For patients receiving single fraction radiation therapy, a contemporary dose plan using ≤ 13 Gy to the tumor margin
- Included a median or mean follow-up of at least 2 years following treatment
- Included a minimum of 20 patients

Studies focusing on NF2 or those reporting outcomes in sporadic and NF2-associated tumors, without providing separate outcome data, were not included for review

The authors did not include systematic reviews, guidelines, or meta-analyses conducted by other authors. These documents were developed using different inclusion criteria than those specified in this guideline. Therefore, they may have included studies that do not meet the inclusion criteria stated above. The authors recalled these documents if their abstracts suggested that they might address one of the recommendations presented here, and the bibliographies were searched for additional studies.

Search Strategies

The task force collaborated with a medical librarian to search for articles published between January 1, 1990 and December 31, 2014. Three electronic databases were searched: PubMed, EMBASE, and Web of Science. Strategies for searching electronic databases were constructed by the evidence-based clinical practice guideline task force members and the medical librarian using previously published search strategies to identify relevant studies (see Table 1 and Figure 1 in the full guideline [see the "Availability of Companion Documents" field]).

The authors supplemented searches of electronic databases with manual screening of the bibliographies of all retrieved publications. The authors also searched the bibliographies of recent systematic reviews and other review articles for potentially relevant citations. All articles identified were subject to the study selection criteria listed above. As noted above, the guideline committee also examined lists of included and excluded studies for errors and omissions. The authors went to great lengths to obtain a complete set of relevant articles. Having a complete set ensures that the guideline is not based on a biased subset of articles.

Number of Source Documents

Ninety-three studies were included as evidence. See Figure 1 in the full guideline (see the "Availability of Companion Documents" field).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

American Association of Neurological Surgeons/Congress of Neurological Surgeons Classification of Evidence on Prognosis and Levels of Recommendation

To evaluate papers addressing *prognosis*, 5 technical criteria are applied:

Was a well-defined representative sample of patients assembled at a common (usually early) point in the course of their disease?

Was patient follow-up sufficiently long and complete?

Were objective outcome criteria applied in a "blinded" fashion?

If subgroups with different prognoses were identified, was there adjustment for important prognostic factors?

If specific prognostic factors were identified, was there validation in an independent "test set" group of patients?

Class I Evidence Level 1 Recommendation	All 5 technical criteria above are satisfied
Class II Evidence	Four of 5 technical criteria are satisfied

Level 2 Recommendation Class III Evidence Level 3 Recommendation	Everything else
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Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Data Analysis

Evidence tables for radiation treatment, microsurgery, and observation were constructed using key study parameters as outlined in the "Description of Methods Used to Collect/Select the Evidence" field. In addition, the percentage of patients who maintained useful hearing at time points between 1 and 10 years and who had serviceable hearing at baseline was recorded according to data available in each study. "Serviceable hearing" or "useful hearing" was defined by a word recognition score of $\geq 50\%$ and a pure tone average or speech response threshold of ≤ 50 dB HL, which is equivalent to American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) class A-B and Gardner-Robertson (GR) grade I-II. The aggregate data obtained from individual studies were summarized via a weighted average to determine the overall percentage of patients with useful hearing at years 1 through 10 for each treatment modality. To accommodate a range of outcomes between studies, 4 ordinal categories of probability were devised for the purpose of guideline formulation: "high probability" of hearing preservation defined by $>75\%$ to 100% , "moderately high probability" defined by $>50\%$ to 75% , "moderately low probability" defined by $>25\%$ to 50% , and "low probability" defined by 0% to 25% .

Methods Used to Formulate the Recommendations

Expert Consensus (Nominal Group Technique)

Description of Methods Used to Formulate the Recommendations

Classification of Evidence and Guideline Formulation

The concept of linking evidence to recommendations has been further formalized by the American Medical Association and many specialty societies, including the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the American Academy of Neurology. This formalization involves the designation of specific relationships between the strength of evidence and the strength of recommendations to avoid ambiguity. In the paradigm for prognostication used in this guideline, evidence is classified into 1 of 3 tiers based upon the degree at which the study fulfills 5 technical criteria as outlined in the "Rating Scheme for the Strength of the Evidence" field.

A basis for these guidelines can be viewed in Haines SJ and Nicholas JS (2006). Evidence-Based Medicine: A Conceptual Framework. In Haines SJ and Walters BC (Eds.), *Evidence-Based Neurosurgery: An Introduction* (Pages 1-17). New York: Thieme Medical Publishers.

Guideline Panel Consensus

Multidisciplinary writing groups were created for each section based on author expertise to address each of the disciplines and particular areas of therapy selected for these clinical guidelines. Each group was involved with literature selection, creation and editing of the evidence tables, and scientific foundations for their specific section and discipline. Using this information, the writing groups then drafted the recommendations in answer to the questions formulated at the beginning of the process, culminating in the clinical practice guideline for their respective discipline. The draft guidelines were then circulated to

the entire clinical guideline panel to allow for multidisciplinary feedback, discussion, and ultimately approval.

Rating Scheme for the Strength of the Recommendations

See the "Rating Scheme for the Strength of the Evidence" field.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Approval Process

The completed evidence-based clinical practice guidelines for the management of vestibular schwannomas (VSs) were presented to the Joint Guideline Committee (JGC) of the American Association of Neurological Surgeons (AANS) and the Congress of Neurological Surgeons (CNS) for review. The reviewers for the JGC were vetted by *Neurosurgery* for suitability and expertise to serve as reviewers for the purposes of publication in that journal also. The final product was then approved and endorsed by the executive committees of both the AANS and CNS before publication in *Neurosurgery*.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Greater patient understanding of hearing preservation rates after contemporary stereotactic radiation delivery, microsurgery, or observation with serial imaging

Potential Harms

Not stated

Qualifying Statements

Qualifying Statements

Disclaimer of Liability

This clinical systematic review and evidence-based guideline was developed by a multidisciplinary physician volunteer task force and serves as an educational tool designed to provide an accurate review of the subject matter covered. These guidelines are disseminated with the understanding that the recommendations by the authors and consultants who have collaborated in their development are not meant to replace the individualized care and treatment advice from a patient's physician(s). If medical advice or assistance is required, the services of a competent physician should be sought. The proposals contained in these guidelines may not be suitable for use in all circumstances. The choice to implement any particular recommendation contained in these guidelines must be made by a managing physician in light of the situation in each particular patient and on the basis of existing resources.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Quick Reference Guides/Physician Guides

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Living with Illness

IOM Domain

Effectiveness

Patient-centeredness

Identifying Information and Availability

Bibliographic Source(s)

Carlson ML, Vivas EX, McCracken DJ, Sweeney AD, Neff BA, Shepard NT, Olson JJ. Congress of Neurological Surgeons systematic review and evidence-based guidelines on hearing preservation outcomes in patients with sporadic vestibular schwannomas. *Neurosurgery*. 2018 Feb 1;82(2):E35-9. [99 references] [PubMed](#)

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2018 Feb 1

Guideline Developer(s)

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

These evidence-based clinical practice guidelines were funded exclusively by the Congress of Neurological Surgeons and the Tumor Section of the Congress of Neurological Surgeons and the American Association of Neurological Surgeons, which received no funding from outside commercial sources to support the development of this document.

Guideline Committee

Vestibular Schwannoma Evidence-Based Practice Guideline Task Force

Composition of Group That Authored the Guideline

Task Force Members: Matthew L. Carlson, MD, Department of Otorhinolaryngology and Department of Neurologic Surgery, Mayo Clinic, School of Medicine, Rochester, Minnesota; Esther X. Vivas, MD, Department of Otolaryngology-Head & Neck Surgery, Emory University School of Medicine, Atlanta, Georgia; D. Jay McCracken, MD, Department of Neurosurgery, Emory University School of Medicine, Atlanta, Georgia; Alex D. Sweeney, MD, Bobby R. Alford Department of Otolaryngology-Head and Neck Surgery, Baylor College of Medicine, Houston, Texas; Brian A. Neff, MD, Department of Otorhinolaryngology and Department of Neurologic Surgery, Mayo Clinic, School of Medicine, Rochester, Minnesota; Neil T. Shepard, PhD, Department of Otorhinolaryngology, Mayo Clinic, School of Medicine, Rochester, Minnesota; Jeffrey J. Olson, MD, Department of Neurosurgery, Emory University School of Medicine, Atlanta, Georgia

Financial Disclosures/Conflicts of Interest

Conflict of Interest

The Vestibular Schwannoma Guidelines Task Force members were required to report all possible COIs prior to beginning work on the guideline, using the COI disclosure form of the American Association of Neurological Surgeons/Congress of Neurological Surgeons (AANS/CNS) Joint Guidelines Committee, including potential COIs that are unrelated to the topic of the guideline. The CNS Guidelines Committee and Guideline Task Force Chair reviewed the disclosures and either approved or disapproved the nomination. The CNS Guidelines Committee and Guideline Task Force Chair are given latitude to approve nominations of Task Force members with possible conflicts and address this by restricting the writing and reviewing privileges of that person to topics unrelated to the possible COIs. The conflict of interest findings are provided in detail in the full-text introduction and methods manuscript (see the "Availability of Companion Documents" field).

Guideline Endorser(s)

American Association of Neurological Surgeons - Medical Specialty Society

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the [Neurosurgery Web site](#) .

Availability of Companion Documents

The following are available:

Congress of Neurological Surgeons systematic review and evidence-based guidelines on hearing preservation outcomes in patients with sporadic vestibular schwannomas. Full guideline. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2017 Dec 22. 111 p. Available from the [Congress of Neurological Surgeons \(CNS\) Web site](#) .

Congress of Neurological Surgeons systematic review and evidence-based guidelines on the treatment of adults with vestibular schwannomas: introduction and methods. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2017 Dec 22. 28 p. Available from the [CNS Web site](#) .

Olson JJ, Kalkanis SN, Ryken TC. Congress of Neurological Surgeons systematic review and evidence-based guidelines on the treatment of adults with vestibular schwannomas: executive summary. Neurosurgery. 2018 Feb 1;82(2):129-34. Available from the [Neurosurgery Web site](#) .

Congress of Neurological Surgeons (CNS). Guideline development methodology: endorsed by the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the AANS/CNS Joint Guideline Committee. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2012 Feb. 12 p. Available from the [CNS Web site](#) .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on May 7, 2018. The information was verified by the guideline developer on June 4, 2018.

This NEATS assessment was completed by ECRI Institute on April 25, 2018. The information was verified by the guideline developer on June 4, 2018.

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